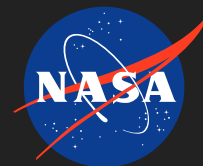


# Completion of the Future SpaceCube-Navigator GPS Flight Platform and Maturation of Key Technologies on the Navigation Technology

## Roadmap

Completed Technology Project (2012 - 2013)



## Project Introduction

Goddard's Navigator GPS receiver is a standalone, high-sensitivity, space-qualified GPS receiver originally designed to enable high-altitude GPS navigation. Navigator is an enabling technology for the Magnetospheric Multi-Scale Mission (MMS) and is a critical navigation sensor for the Global Precipitation Measuring Mission (GPM) mission. Navigator GPS technology has been licensed to Broad Reach Engineering (BRE) in 2010 which builds an improved size, weight and power (SWaP) variant of the Navigator. The current design of the Navigator is resource constrained, inflexible and does not allow for expansion and incorporation of new capabilities. In the work performed under this IRAD, the current Navigator design is ported to Goddard's SpaceCube 2.0 flight platform, which is a more flexible and scalable flight platform. In addition, more capabilities will be added to the Navigator including digital beamforming of a phased-antenna array and the modernized GPS L2C and L5 signals tracking capabilities.

Goddard's SpaceCube 2.0 is the latest in a line of compact, high-throughput, reconfigurable signal-processing platforms for space applications. Different versions of the SpaceCube have served or will serve on numerous missions including the Materials International Space Station Experiment (MISSE-7), the Hubble Space Telescope Servicing Mission 4 (HST-SM4), Small Rocket/Spacecraft Technology (SMART), Intelligent Payload Experiment (IPEX) CubeSat mission, and the geostationary robotic servicing RESTORE mission. The work performed in this project consists of porting the Navigator GPS receiver to SpaceCube 2.0 flight platform. This involves porting Navigator's software and firmware to SpaceCube and building a GPS radio frequency (RF) front-end electronics that will interface the GPS antennas to the signal processing module on the SpaceCube 2.0 chassis. Porting Navigator to SpaceCube will significantly advance the utility of SpaceCube by incorporating navigation capabilities that are currently lacking. Additionally, the flexibility and expandability of SpaceCube will allow for adding new capabilities to the Navigator GPS receiver including digital beamforming of a phased-antenna array and the modernized GPS L2C and L5 signals tracking capabilities.

## Anticipated Benefits

Goddard's Navigator GPS receiver technology has been a mission enabler for the Magnetospheric Multi-Scale Mission (MMS) and will serve as a critical navigation sensor for the Global Precipitation Measuring Mission (GPM) mission.



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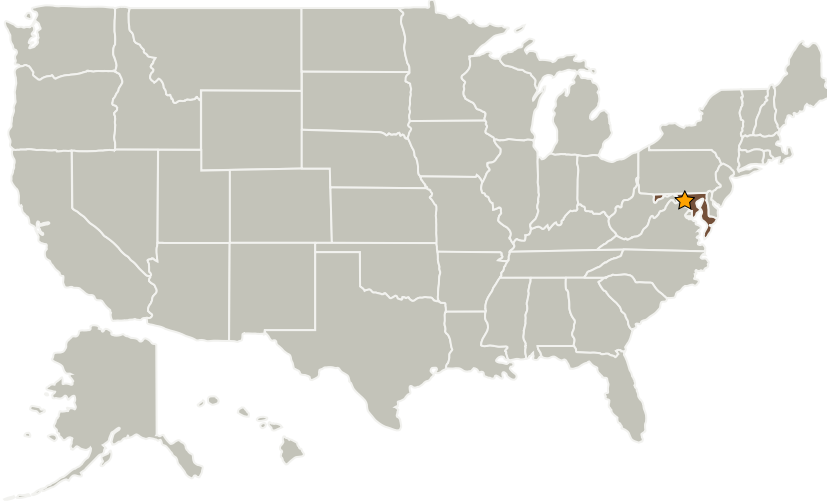
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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Goddard Space Flight Center (GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

### Primary U.S. Work Locations

Maryland

### Project Website:

<http://aetd.gsfc.nasa.gov/>

## Organizational Responsibility

### Responsible Mission Directorate:

Mission Support Directorate (MSD)

### Lead Center / Facility:

Goddard Space Flight Center (GSFC)

### Responsible Program:

Center Independent Research & Development: GSFC IRAD

## Project Management

### Program Manager:

Peter M Hughes

### Project Manager:

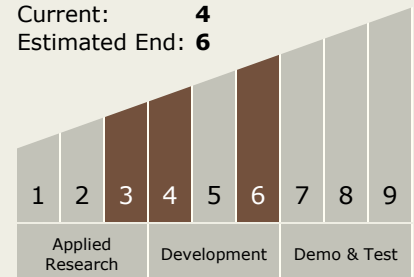
John C Adams

### Principal Investigator:

Munther A Hassouneh

## Technology Maturity (TRL)

Start: 3  
Current: 4  
Estimated End: 6



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## Technology Areas

### Primary:

- TX17 Guidance, Navigation, and Control (GN&C)
  - └ TX17.4 Attitude Estimation Technologies
    - └ TX17.4.3 Attitude Estimation Sensors